

# GLAST Balloon Flight Analysis - an Outline

## Analysis Goals of the GLAST BFEM Balloon Flight

1. Demonstrate that we can find gamma rays in flight data from a GLAST tower, i.e show that event reconstruction works. This one is absolutely essential.
2. Demonstrate that the XGT-tagged events match the GEANT4 simulation - flux, energies, directions
3. Re-confirm previous atmospheric gamma-ray measurements - flux, energy spectrum, zenith angle distribution.
4. Verify efficiency of proposed L2T and L3T algorithms.

# BFEM Analysis Roadmap - From Raw Bits to Scientific Results

## Level 0 - Interpreting the bits - geometry and detector response

### GEANT4 simulation

Detector geometry and materials  
Expected signals from incident radiation -  
data format/file structure, event display.

Validation - verify  
geometry,  
data definitions

### BFEM Instrument

Detector geometry  
Data stream definition/ data format /file  
structure, event display

## Level 1 - Data Storage, Integrity, and Manipulation - data processing on raw ROOT files

Runs definition - by incident radiation  
type, distribution, trigger mode  
Database of runs  
Performance data - histograms, rates,  
triggering, etc.  
Event reconstruction

Validation - compare  
tracks, efficiencies of  
subsystems, alignment

Runs definition - by BFEM trigger mode,  
time  
Database of runs  
Performance data - histograms, rates,  
livetime, triggering, scaling, offsets, etc. ★  
Event reconstruction

## Level 2 - Extraction of Instrument Response and Science Data - from reconstructed ROOT files

Screening/filters/cuts of event types  
(particles, photons, XGT tagged,  
unknown, etc.) ★  
Derive response functions ★

Validation - compare  
efficiency of same  
screening in selecting  
event classes

Screening/filters/cuts of event types  
(particles, photons, XGT tagged,  
unknown, etc.) ★  
Produce identified-event data base ★

----- This is where the derived instrument parameters and flight data are turned over to the users -----

## Level 3 - Scientific Results

**Response functions for different  
types of incident radiation ★**  
e.g. Effective area, PSF,  $\Delta E/E$  vs. angle,  
energy, trigger mode for photons

Calibration - use model  
to convert observed  
data to results

**Flux, energies, tags, angular distribution  
of various types of radiation ★**

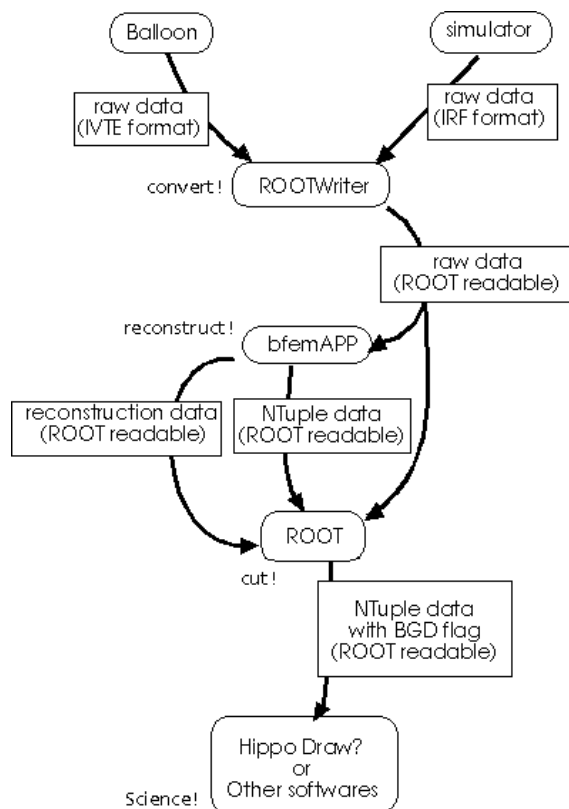
★ - some areas where work is needed

# What Needs Attention Now?

- Perform subsystem performance checks/calibration
  - TKR - did more strips become hot during flight?
  - ACD - what is the appropriate PHA cut for MIPs?
  - CAL - what is a reasonable energy calibration?
- Encourage anyone interested in BFEM data to scan some flight events using an event display
- Adjust simulations to reproduce trigger rate - iterative
- **Develop effective screening methods (next slide) to categorize events - critical to finding the gamma rays**
- Apply screening to simulations and flight data
  - Simulations give effective area
  - Flight data give numbers of gamma rays (and other particles)
- Use these results, along with live time, to compare with expected photon and particle fluxes

# Approaches to Screening the Event Data

## The Systematic Approach (like the flight data)



Kotani and others

## The Empirical Approach

Use energy deposits and topologies to categorize events with simple rules

e.g. No ACD energy + inverted V track shape in TKR and CAL is probably a gamma ray

For this small data set, this method gives a useful “sanity check” on the data.

Lauben, Giebels

# Who's Who in the GLAST BFEM Analysis World

**Analysis Coordinator (“Czar”) - Dave Thompson**

**Analysis Consultant - Eduardo do Couto e Silva**

## **Definitions -largely done**

Geometry - Tsunefumi Mizuno, Gary Godfrey  
Data Format - JJ Russell  
Data Validation - Dave Lauben, Scott Williams

## **Simulations**

Tune Kamae  
Tsunefumi Mizuno  
Takanobu Handa  
Michael Roterman  
Sei Ogata  
Hirofumi Mizushima

**Heavy CR Analysis**  
NRL

## **XGT Analysis**

Tune Kamae  
Tsunefumi Mizuno  
others?

## **Subsystem Performance**

ACD - Alex Moiseev  
Tracker - Alicia Kavelaars?  
Calorimeter - Eric Grove  
XGT - Tsunefumi Mizuno  
BIU - Michael Lovellette  
GSE - Dave Lauben, Scott Williams

## **On-board Software - done**

JJ Russell  
Tony Waite  
Dan Wood  
Bob Schaefer

**Hadron Analysis**  
UCSC

## **Atmospheric Analysis**

Dave Thompson, Dave Lauben,  
Dave Wren, others?

## **Data Management and Integrity**

Karl Young, Tony Waite

## **Analysis Software Development**

Lead - Richard Dubois  
Data packaging - Heather Kelly  
ROOT classes – Heather Kelly  
Event reconstruction – Tracy Usher, Leon Rochester  
Event display - Gloria Spandre, Nick Lumb

## **Event cuts, screening, identification**

Systematic - Taro Kotani, others?  
Empirical - Dave Lauben, Berrie Giebels, others?

**Other Analysis? Who?**